

METHODS OF TREATING ANDROGEN DEFICIENCY IN MEN USING SELECTIVE  
ANTIESTROGENS

BACKGROUND OF THE INVENTION

The invention relates to the new use of antiestrogens for the production of a pharmaceutical agent for treating a relative androgen deficiency in men.

In men, increasing age leads to a reduction of testicular androgen production and androgen concentration in the organism. In contrast to the situation in women, in whom estrogen production drops to castration values within a comparatively short period, this takes decades in men and involves a gradual drop. The total concentration of testosterone in the serum in the older age group is significantly reduced compared to the values in young men. Because of the increase in steroid hormone-binding globulin (SHBG) that coincides with the aging process, moreover, the proportion of free, unbound, and thus biologically active testosterone drops. In addition, the serum levels of estrogens, although they are produced from androgens by direct conversion, do not drop in the same way as a function of age. As a result, the hormonal environment is significantly altered.

In men, the hormonal environment of the sexual steroids is characterized by a significant preponderance of

androgens over estrogens. While the circulating main component of androgens, testosterone, is detected in the serum in units in the range of nmol/l, the estrogen antagonist, estradiol, can be measured only in the range of pmol/l. This considerable preponderance of androgen can be detected basically in the entire late puberty period of life, but there is a clearly different intensity of this androgen dominance as a function of age. With increasing age and particularly so in those over the age of 60, there is a less pronounced emphasis of the androgen preponderance.

In older men there are relative decreases in the preponderance of testosterone by 30-50% compared to the previous values found in young men.

The relative testosterone deficiency per se can be regarded as responsible for a number of age-related disorders. Reduction of muscle mass accompanied by limitation of body performance capacity, reduction of bone density and in individual cases even osteoporosis, an increase in prostate size referred to as benign prostatic hyperplasia, reduction of libido and potency, and psycho-vegetative disorders such as depression, which are disorders that are often generically referred to as Male Menopause and are caused by relative androgen deficiency in men. Libido is the desire to obtain an erection, while potency is the ability to have that erection.

It is known that in younger men, testosterone values are also effectively increased by daily treatment with

antiestrogens to treat male infertility. Treatment of Male Infertility, Springer-Verlag Berlin, Heidelberg, New York 1982; Fuse, H. et al., Archives of Andrology 31 (1993) 139-145; Nonsurgical Treatment of Male Infertility, Jarow, J., Infertility in the Male, pp. 410-422. However, it has been thought that antiestrogens do not seem well suited for treatment of a relative androgen deficiency in men. Thus, for example, U.S. patent 5,861,389 proposes the use of at least one aromatase inhibitor for the production of a pharmaceutical agent for treating a relative androgen deficiency in men.

#### SUMMARY OF THE INVENTION

The object of the present invention is to treat a relative androgen deficiency in older men and/or the specific disorders related to male menopause by the use of antiestrogens.

It has been noted that the use of antiestrogens in treating a relative androgen deficiency in older men results surprisingly in a long-term increase in the androgen level.

By gradually stimulating the body to produce testosterone, the antiestrogens result in an endogenic rebalancing of the testosterone/estrogen ratio in men. As a result, the relative androgen deficiency is compensated for.

For the purposes of this invention, antiestrogens are all those compounds that compete with estrogen for estrogen-receptor-binding sites and may delay replenishment of

intracellular estrogen receptors. As antiestrogens, therefore, all such compounds are suitable, such as, for example:

tamoxifen citrate which is the trans-isomer of a triphenylethylene derivative. The chemical name is (Z)2-[4-(1,2-diphenyl-1-butenyl) phenoxy]-N, N-dimethylethanamine 2-hydroxy-1,2,3- propanetricarboxylate (1:1) and sold under the trademark Novladex; and

clomiphene citrate which is 2[p-(2- chloro-1,2-diphenylvinyl) phenoxy]] trieth lamine citrate (1:1). It has the molecular formula of  $C_{26}H_{28}ClNO \cdot C_6H_8O_7$  and a molecular weight of 598.09 and is sold under the trademark Clomid.

The list of antiestrogens above is not exhaustive, other compounds that meet the set requirements, are also considered.

A pharmaceutically effective dosage of the antiestrogen is administered in older men for an effective time period, preferably continuously. For example, at a daily dose of 5-10 mg once or twice a day, tamoxifen is administered to obtain a target range of mid-normal testosterone levels. A dose of 10-25 mg of clomid daily or every other day and up to 100 mg is administered to obtain the mid-normal levels. Measuring the serum concentration of testosterone and estradiol can thus give early indication of whether the desired hormone balance was achieved and optionally whether dose adjustment can be undertaken.

When antiestrogens are used for treating male menopause, the estrogen concentration is effectively lowered. The easy controllability of the treatment distinguishes treatment with an antiestrogen. For 10 mg tablets, each tablet contains 15.2 mg of tamoxifen citrate which is equivalent to 10 mg of tamoxifen. For 20 mg tablets, each

tablet contains 30.4 mg of tamoxifen citrate which is equivalent to 20 mg of tamoxifen. The inactive ingredients are carboxymethylcellulose calcium, magnesium stearate, mannitol and starch.

Clomiphene citrate tablets is a mixture of two geometric isomers [cis (zuclomiphene) and trans (enclomiphene)] containing between 30% and 50% of the cis-isomer. A standard commercially available tablet contains 50 mg clomiphene citrate and the following inactive ingredients: corn starch, lactose, magnesium stearate, pregelatinized corn starch, and sucrose. The current tablets are used primarily for treating female infertility. Treatment according to the present invention contemplates a redosing to accommodate the lower dosages specified herein.

It is also contemplated that combinations of antiestrogens can be administered or that combinations of antiestrogens and other testosterone producing drugs can be used.